amongst the stars should be noted at short intervals. In the case of a streak enduring ten minutes, a series of diagrams showing the positions of the streak and neighbouring stars every two minutes would be valuable.

There is a large amount of data available from past observations, but it is for the most part of very rough imperfect character, and we require more exact and complete records before we can determine the exact heights of the streaks and the motions of the outer atmosphere. However, the discussion so far as it has gone proves that the streaks are usually from fifty to sixty miles high, and that their motion is often more than one hundred miles an hour. A very destructive hurricane on the earth's surface would about equal this, so that it is certain that the upper tenuous air is influenced by currents of far swifter character than the atmosphere immediately overlying the earth.

If observers of meteors will only carefully record meteoric streaks and trains whenever they are seen we shall soon be in a position to ascertain more trustworthily and definitely the behaviour of these curious afterglows. From balloon ascents it has been concluded that the general drift of the air in the region of ten or fifteen miles altitude is to E. and S.E., and this precisely accords with the direction of the majority of meteoric trains between about fifty and sixty miles high.

W. F. Denning.

Bristol, July 13.

Climatic Change.

I have just seen the translation of Prof. Albrecht Penck's lecture on "The Shifting of the Climatic Belts," printed in the *Scottish Geographical Magazine* for June, 1914. The main line of the author's argument is that certain lakes—*e.g.* Lake Chad in the Sahara, the lakes of Mexico City, and of the Titicaca basin, being very slightly salt, indicate an *increasing* precipitation, and during the so-called "pluvial period" were drier than at present, owing to a shifting of the arid belt equatorwards.

Surely it is more reasonable to attribute the comparatively slight salt content to the fact that the basins have only recently ceased to have an outlet, owing to a *decrease* in the precipitation. A slow fluctuating decrease in the rainfall of Mexico has been practically proved by Prof. Ellsworth Huntington (*e.g.* "The shifting of climatic zones as illustrated in Mexico," Bull. Amer. Geogr. Soc., vol. xlv., 1913, Jan.–Feb., and also his recent memoir on the "Climatic Factor"). In the case of Lake Chad, K. v. Zittel, an accomplished observer, describes evidence of a former greater extent (*Palaeontographica,* vol. xxx., 1883, p. 39). Information as to whether the lake has an old outflow channel would be valuable.

So long ago as 1876 A. Agassiz, in his "Hydrographic Sketch of Lake Titicaca" (Proc. Am. Acad., vol. xi., 1876 p. 268), wrote: "The whole of this district is receiving a much smaller waterfall than in former times."

Prof. Penck is unfortunate in his examples; the weight of evidence against him, pointing to a former moister period on the equator side of the arid belts, is too great to be ignored. And as he admits desiccation on the poleward sides of these belts, the facts suggest that the dry area may vary in breadth as well as in position, and that the "pluvial period" had a real existence—*outside the glaciated regions.*

Chas. E. P. Brooks.

"Homeleigh," 3 Roseleigh Avenue, Highbury, N.
July 17.

THE PLUMAGE PROHIBITION BILL.

Before these lines are published the fate of the Plumage Prohibition Bill may have been decided. It seems little to our credit that London should be the chief market for the nefarious traffic which this Bill was framed to abolish; and this view was surely endorsed by the House when, on the second reading, the Bill was passed by a majority of nearly three hundred. Nevertheless, during the committee stage the Bill was virulently opposed by a small, well-organised minority, including some actually engaged in the sale of plumage for millinery purposes.

Unfortunately, the hands of the opposition have been strengthened by the action of "The Committee for the Economic Preservation of Birds"—a committee which, strangely enough, does not contain the name of a single ornithologist of repute. So completely have these opposing forces contrived to play into one another's hands that it is probable that, to save the Bill, it will have to be modified. For total prohibition a schedule will have to be substituted, which must be so framed as to secure the safety of such species as are at present in actual danger of extermination.

It would be useless to urge the need of preserving these threatened species because of their immense value as living witnesses of the evolution theory; for science, and scientific problems, have little weight in this country. But, if for no other reason than that of its inhumanity, this ghastly traffic should be ended.

The contention that if this Bill passes a large number of workpeople will be thrown out of employment has been shown, on figures furnished by the trade itself, to be without justification. Equally groundless is the assertion that the placing of the Bill on the Statute Book will simply divert the trade to Paris without saving the life of a single bird. If there were any sort of foundation for this, the French Chamber of Commerce would not have implored the British Government to throw out this Bill. Furthermore, we are assured that if this Bill passes, Germany will follow our lead. This done, the plume-trade in Europe is dead.

If only an emasculated Bill succeeds in running the gauntlet of trade interests a step in the right direction will have been achieved. If, on the other hand, the present Bill is defeated, then it is fervently to be hoped that a new Bill will be introduced at the earliest possible moment; and having regard to the voting on the second reading of the present Bill, there is every reason to regard its success as assured.

SPACE AND TIME.[1]

"From this time forth space and time apart from each other are become mere shadows, and only a kind of compound of the two can have any reality." So spoke Herrmann Minkowski in 1908. But his statement has not yet been realised.

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[1] H. A. Lorentz, A. Einstein, H. Minkowski: Das Relativitätsprinzip. A Collection of the Classical Papers in the Development of the Theory of Relativity, from 1895 to 1910. Pp. 89, with portrait of Minkowski. (Leipzig: B. G. Teubner, 1913.) Price 3 marks.

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It is still the elect to whom it is given to escape from the bondage of their own consciousness so completely that they can think of time as nothing more than the most convenient means of ordering events. Sir Oliver Lodge was voicing the feeling of the man in the street when, at Birmingham, he said: "Surely, we must admit that space and time are unchangeable: they are not at the disposal even of mathematicians."

It is not so long since a similar divergence of view existed in respect of the other fundamental dynamical magnitude *mass*. But here the controversy has subsided; the mass of a body is still something more than a shadow, though no teacher of dynamics would to-day think of defining it as "the quantity of matter" in it. Rather the conception has gained in concreteness through its separation from the crude intuitive notion of heaviness, through the realisation that no precise definition is possible apart from the uniformity which is expressed in the laws of motion.

A reader of "The Grammar of Science" might well have exclaimed: "From this day forth mass is a mere shadow." But no one now would assert that mass as a measurable quantity is an *a priori* and obvious concept, independent of the phenomena of motion.

Now, apart altogether from the particular assumption of the principle of relativity that electrical phenomena cannot reveal an absolute motion, it was implied by its founder that as measurable quantities space and time are on exactly the same footing as mass, in that they are inseparable from the uniformities which they are used to describe. They are no more at the disposal of the metaphysician than of the mathematician. The psychologist is within his province in endeavouring to elucidate the nature of the consciousness of duration, but in the region of exact physical measurement this aspect of time is eliminated, so that only experiment can say whether there is, for instance, a unique sense in which two events at different places are simultaneous. It is exactly this which experiment has failed to do. Whether it will ever do so cannot be foreseen; the principle of relativity seeks to examine some of the consequences of assuming that it will not. But it is for the present generation to decide whether it is a sound scientific principle that time, like other physical concepts, is dependent for its significance on the observation of uniformity in physical processes, and that the reality of it to our minds is only due to the unbroken regularity of these processes. In this sense we may surely say with Sir Oliver Lodge that space and time are unchangeable, but at the same time we must leave it to nature to tell us what they are, and not foist upon the measures of them a metaphysical significance borrowed from a conceptual scheme which has been outgrown by experiment as the dynamical universe conceived by Laplace has been. The small volume before us embodies the classical papers, in which the gradual transition from the Newtonian thought about space and time to this point of view is developed.

THE HAVRE MEETING OF THE FRENCH ASSOCIATION.

THE arrangements are now complete for the visit of members of the British Association who have been unable to take part in the meeting in Australia, to the congress of L'Association Française pour l'Avancement des Sciences at Havre, beginning on Monday, July 27, and ending Sunday, August 2. Nearly one hundred members have intimated their intention of availing themselves of the courteous and kindly invitation with which they have been honoured by the French society. Among them are about fifty delegates of the associated and affiliated societies which are in correspondence with the British Association. The council of that association has approved of the holding of a meeting of the conference of delegates at Havre during the present year, to be followed later on, if necessary, by a meeting in London for any formal business that may still require to be done.

The session of the conference of delegates will be held at Havre on Tuesday, July 28, at 2.45 p.m., and as it forms part of the accepted programme of the French Association, it is hoped that it may be attended by many members of that association. It will be presided over by Sir George Fordham, who will deliver an address, in which he will direct attention to the work of the conference, since its establishment in 1885, and that will be followed by a discussion, in which the functions of local societies will, it is hoped, be considered from an eminently practical point of view. There is, it is understood, a strong feeling among scientific men in France in favour of the organisation of local societies in that country upon similar principles, and it would be very satisfactory if one result of this joint meeting should be to facilitate the movement in that direction.

At the opening meeting of the congress, to be held in the Grand Theatre, Place Gambetta, on Monday, July 27, at 2.30, Sir William Ramsay will speak as the principal representative of the British Association. In the sectional meetings on the four following days, several papers will be contributed by the English visitors. On Friday, July 31, at 2.30, a general Anglo-French meeting will be held, at which it is proposed that the subject of the Channel Tunnel should be discussed, and on the evening of the same day a discourse will be delivered by a member of the British Association in the Grand Theatre. Thursday, July 30, will be devoted to an excursion to Rouen, and the congress will conclude with a cruise and visit to Cherbourg on the Transatlantic steamer *La Touraine*.

The committee to which the council of the British Association has entrusted the making of these arrangements owes much gratitude to Dr. A. Loir, who two years ago conveyed the invitation of the French Association to the meeting at Dundee, and has been most assiduous in his care for the comfort of the English visitors. The invitation is felt to be a very graceful act on the part of the French Association.

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